**IN THE CLAIMS**

1. (previously presented) A breathing assistance apparatus capable of operating in alternating inhalation and expiratory phases, the apparatus comprising:

a pressurized respiratory gas source,

an inhalation duct to supply gas from the pressurized respiratory gas source to a patient,

an expiratory duct for expiratory gas of the patient,

an inhalation valve disposed on the inhalation duct, the inhalation valve comprising means to allow the gas from the gas source to pass to make possible proportional operation

an expiratory valve on the expiratory gas duct to help establish a positive expiratory pressure,

a pressure sensor and a flow rate sensor associated with the inhalation duct, and

a comparator configured for transmitting an operating reference value of a gas related parameter to the pressurized respiratory gas source for the control of said gas source operation between or during the inhalation and expiratory phases, said comparator having a first input for one or more reference values of the gas related parameter, and a second input being connected to a switch configured for real time selective connection of the comparator with the pressure sensor or the flow rate sensor, allowing real time transmission of a pressure signal or flow rate signal, the position of said switch determining a barometric or volumetric mode of the apparatus,

said switch being controlled by an automatic control unit, distinct from the comparator, said automatic control unit controlling the inhalation valve operation and receiving measurements from the pressure sensor and the flow rate sensor.

2. (previously presented) Apparatus according to claim 1, wherein during the expiratory phases of the apparatus, the

inhalation valve is operable to generate a leak rate to compensate leaks, so that no additional leak connection has to be fitted in parallel to the inhalation valve.

3. (previously presented) Apparatus according to claim 1 or claim 2, wherein the pressurized respiratory gas source comprises a centrifugal fan type turbine with an axial air intake and peripheral output and with an inertia value less than around 150 $gcm^2$.

4. (previously presented) Apparatus according to claim 1, further comprising:

a second flow rate sensor associated with the expiratory duct, and

comparison means, wherein the flow rate sensors associated with the inhalation and expiratory ducts are connected to the comparison means to compare respective flow rates in the inhalation and expiratory ducts.

5. (previously presented) Apparatus according to claim 4, further comprising filtering means operable to filter a difference between the respective flow rates in real time, the filtering means being associated with the comparison means.

6. (previously presented) Apparatus according to claim 5, wherein the filtering means is connected to the automatic control unit, to a memory, and to triggering means programmed to trigger a new inhalation phase when the filtered difference is higher than a pre-determined threshold.

7. (previously presented) Apparatus according to claim 1, wherein the inhalation valve comprises:

a valve body comprising an orifice connected to the inhalation duct, and,

a moving element operable to block the orifice in a closed position, and to at least partially free the orifice in an open position, the moving element including a recess for aligning with the orifice to allow the gas from the gas source to pass through to the inhalation duct, the recess comprising:

a first part whose geometry is generally triangular, corresponding to a proportional operation of the inhalation valve when the first part is aligned with the orifice, and

a second part whose geometry is generally rectangular, corresponding to a wide open operation when the second part is aligned with the orifice.

8. (previously presented) Apparatus according to claim 7, wherein the recess is shaped so that when the moving element moves the inhalation valve from the closed position to the open position, the first part is aligned with the orifice and then the second part is aligned with the said orifice if movement continues.

9. (previously presented) Apparatus according to claim 8, wherein:

a base of the triangle of the first part of the recess is parallel with one side of the rectangle of the second part of the recess.

10. (previously presented) Apparatus according claim 1, further comprising a micro-turbine operable to control the expiratory valve so that the positive expiratory pressure is controlled.

11. (previously presented) Apparatus according to claim 10, wherein the micro-turbine is directly connected to the expiratory valve and no intermediate element is positioned between the micro-turbine and the expiratory valve.

12. (previously presented) An operating control process for controlling a breathing assistance apparatus comprising a pressurized respiratory gas source; an inhalation duct to supply gas from the pressurized respiratory gas source to a patient; an expiratory duct for expiratory gas of the patient; an inhalation valve disposed on the inhalation duct, the inhalation valve comprising means to allow the gas from the gas source to pass to make possible proportional operation; an expiratory valve on the expiratory duct to help establish a positive expiratory pressure; a pressure sensor and a flow rate sensor associated with the inhalation duct; and a comparator configured for transmitting an operating reference value of a gas related parameter to the pressurized respiratory gas source for the control of said gas source operation between or during the inhalation and expiratory phases,

said comparator having a first input for one or more reference values of the gas related parameter, and a second input being connected to a switch configured for real time selective connection of the comparator with the pressure sensor or the flow rate sensor, allowing real time transmission of a pressure signal or flow rate signal, the position of said switch determining a barometric or volumetric mode of the apparatus, said switch being controlled by an automatic control unit, distinct from the comparator, said automatic control unit controlling the inhalation valve operation, and receiving measurements from the pressure sensor and the flow rate sensor,

the process comprising:

operating a micro-turbine; and

closing the expiratory valve based on the micro-turbine to regulate a positive expiratory pressure during the expiratory phases.

13. (previously presented) Process according to claim 12, wherein the micro-turbine operates constantly and the expiratory valve is controlled by selective connection of a pneumatic control line of the expiratory valve with the micro-turbine.

14. (previously presented) A process for operating a breathing assistance apparatus in a volumetric mode, the breathing assistance apparatus comprising a pressurized respiratory gas source; an inhalation duct to supply gas from the pressurized respiratory gas source to a patient; an expiratory duct for expiratory gas of the patient; an inhalation valve disposed on the inhalation duct, the inhalation valve comprising means to allow the gas from the gas source to pass to make possible proportional operation; an expiratory valve on the expiratory duct to help establish a positive expiratory pressure; a pressure sensor and a flow rate sensor associated with the inhalation duct; and a comparator configured for transmitting an operating reference value of a gas related parameter to the pressurized respiratory gas source for the control of said gas source operation between or during the inhalation and expiratory phases, said comparator having a first input for one or more reference values of the gas related parameter, and a second input being connected to a switch configured for real time selective connection of the comparator with the pressure sensor or the flow rate sensor, allowing real time transmission of a pressure signal or flow rate signal,

the position of said switch determining a barometric or volumetric mode of the apparatus, said switch being controlled by an automatic control unit distinct from the comparator, said automatic control unit controlling the inhalation valve

operation, and receiving measurements from the pressure sensor and the flow rate sensor,

the process comprising:

selecting the volumetric mode; and

controlling the gas source on the basis of a measured flow rate parameter on the inhalation duct;

wherein control of volume of the gas delivered to a patient is obtained by the control of the gas source.

15. (previously presented) Process according to claim 14, wherein no pressure difference between upstream and downstream parts of the inhalation valve is used.

16. (previously presented) Process according to claim 14, wherein control of the gas source is obtained through control of the rotation speed of a rotor of the gas source.